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(54) **Coin sorting apparatus**

(57) In a coin sorting apparatus, coins are directed to recesses 6 present in a rotary disc 4, each recess passing one or more coin identifying stations where any coin present in the recess is identified, and then passing coin delivery chutes 8, appropriate coins being ejected as the recess passes the appropriate coin delivery chute. Signals representative of the value of a coin in a recess are supplied to a shift register and, as the coin advances, so the signal is shifted. As the coin passes each coin transportation path the signal in the shift register is compared with a corresponding signal in a memory and when there is identity of signals the coin is ejected from the recess to follow the coin transportation path.

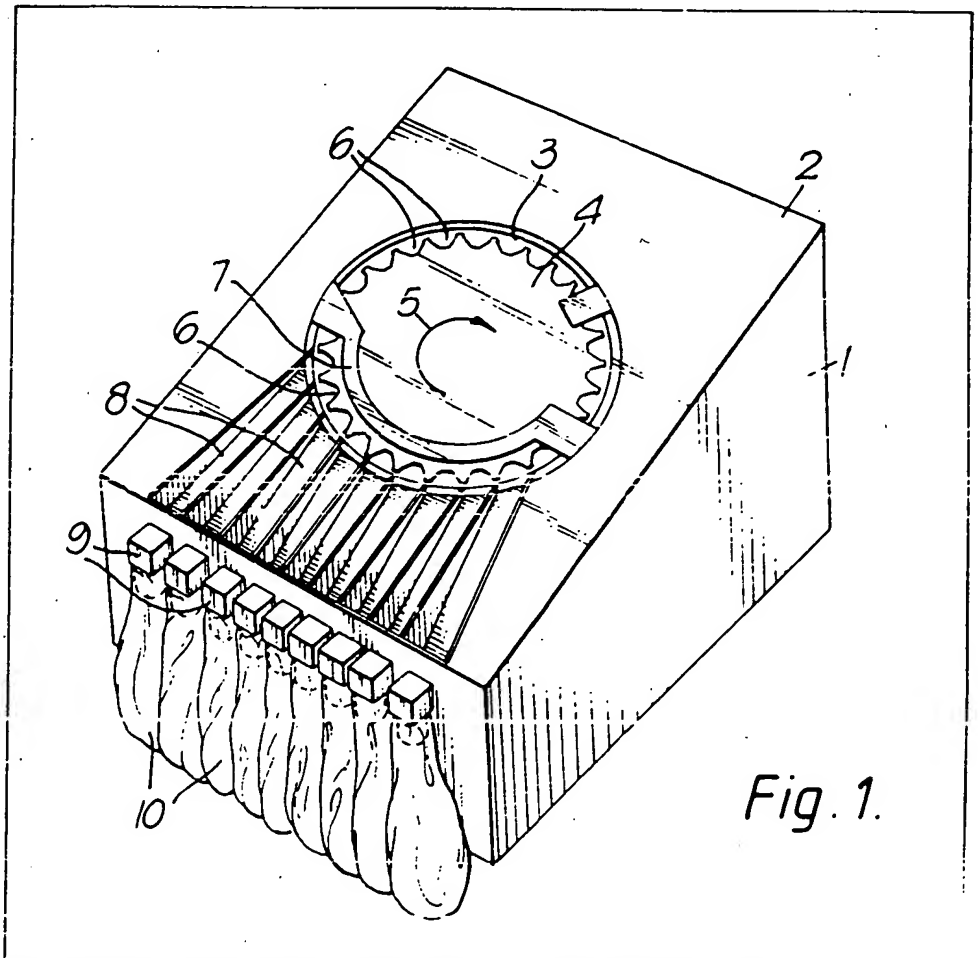

Fig. 1.

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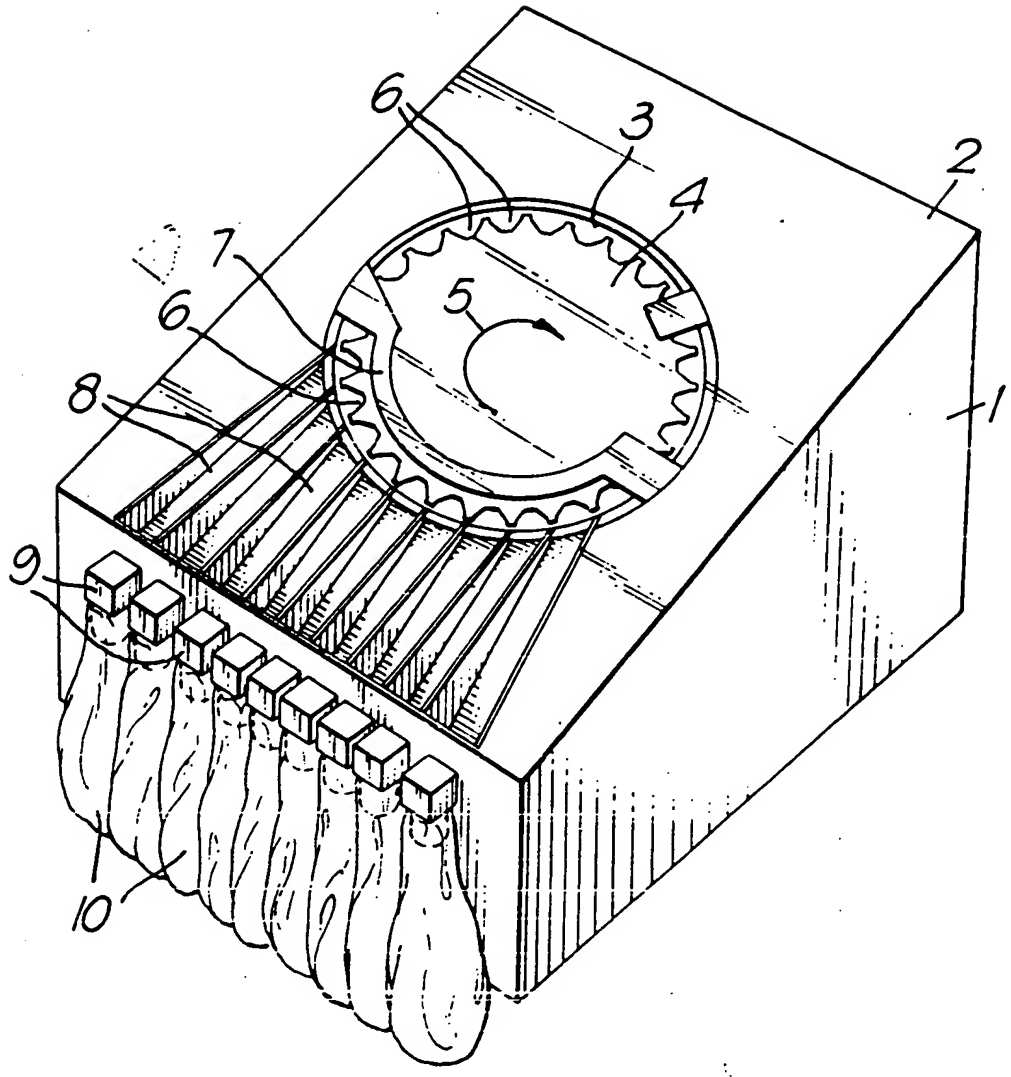
Fig. 1.



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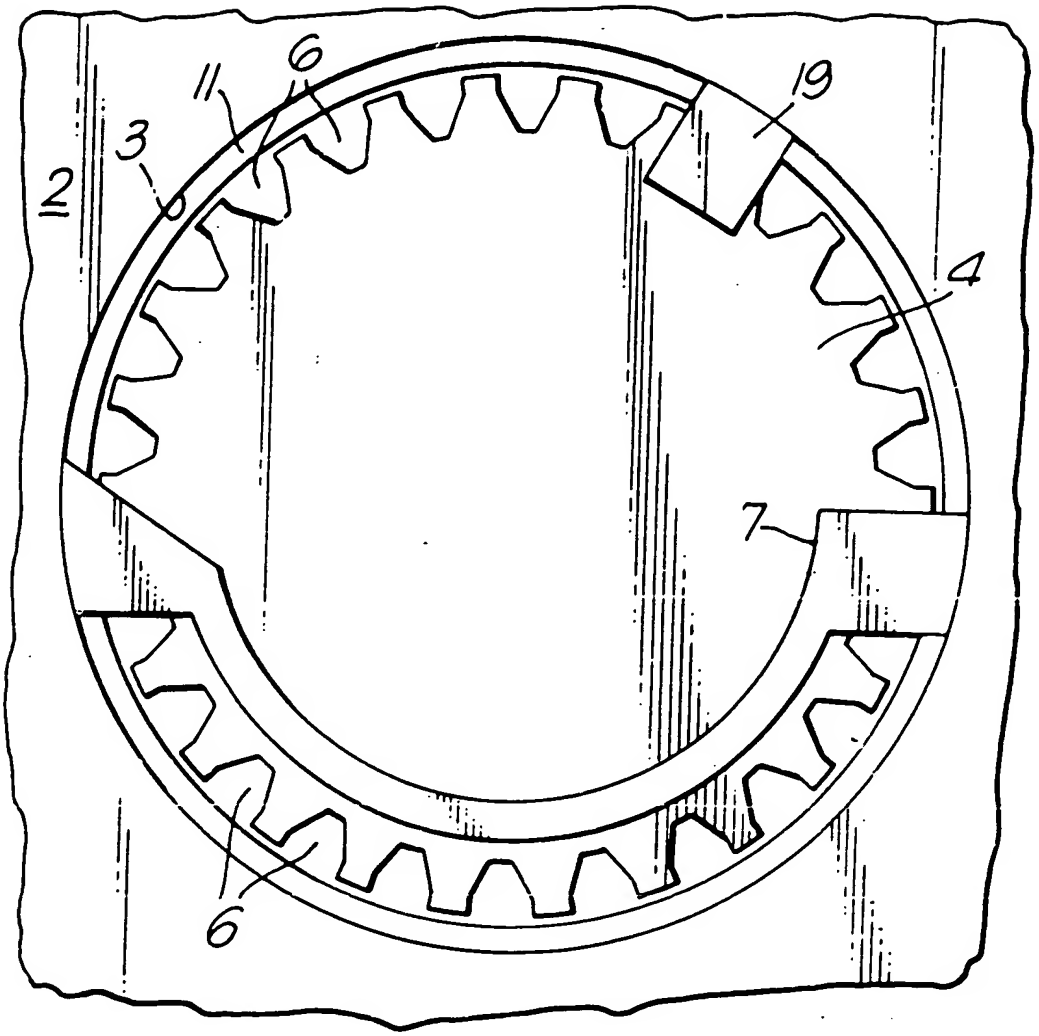

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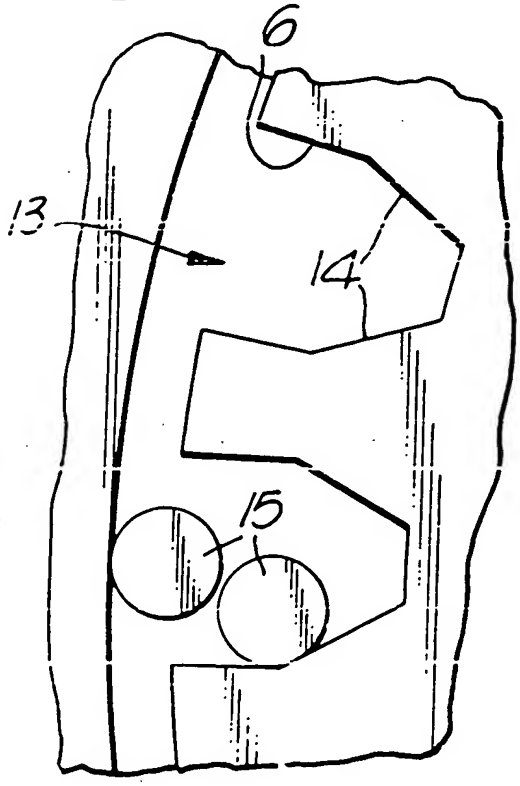
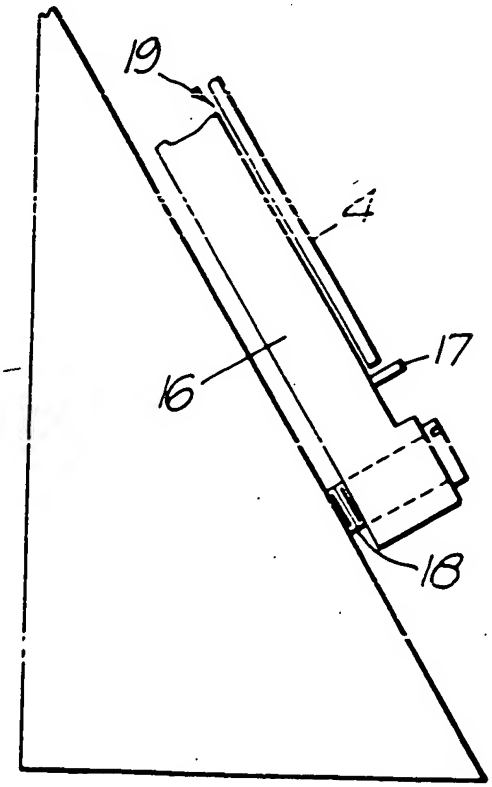


Fig.5.



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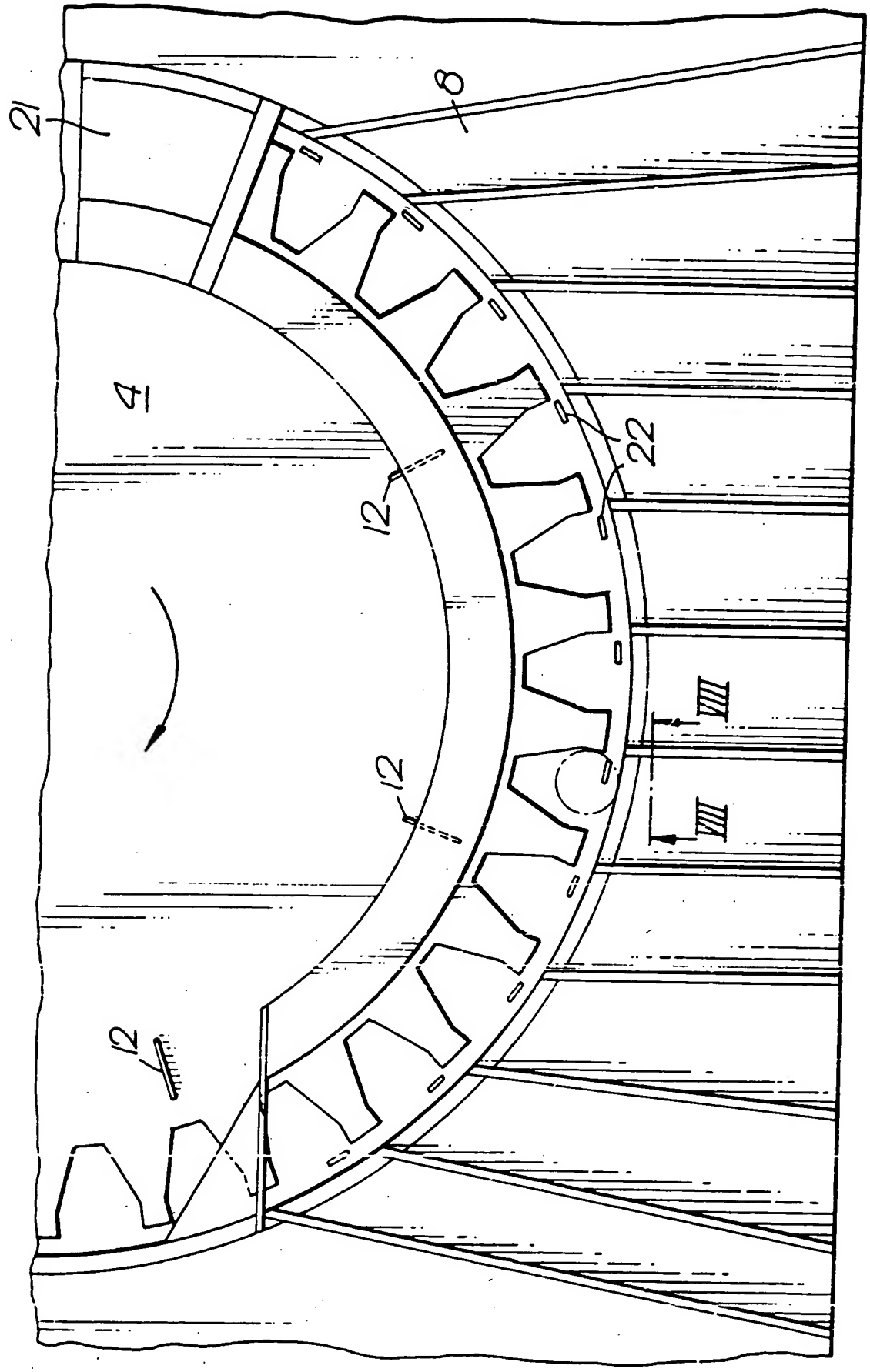

Fig. 3.

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Fig. 6.

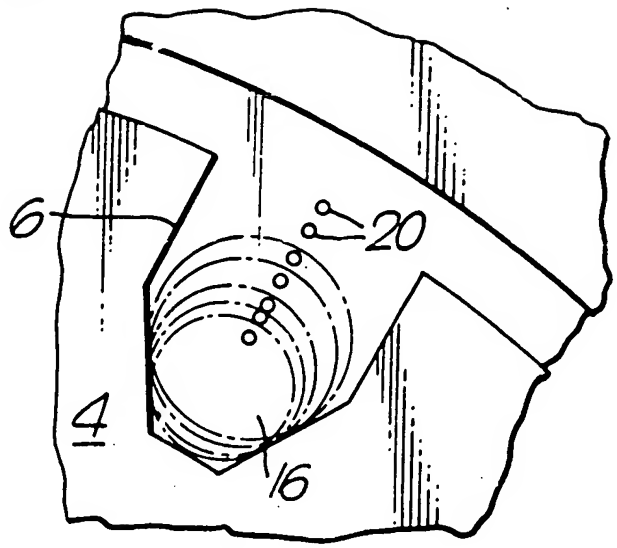

Fig. 7.

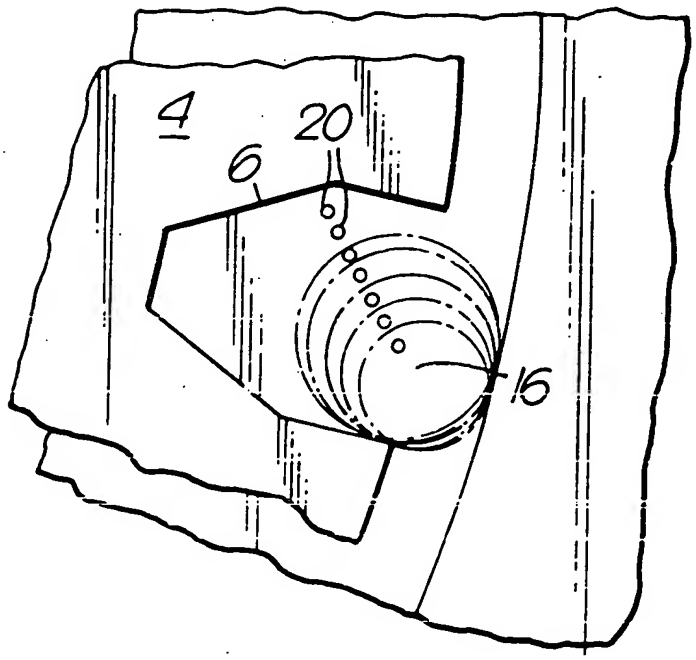

Fig. 8.

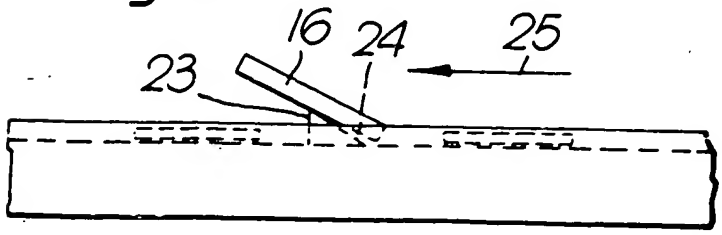

Fig. 9.

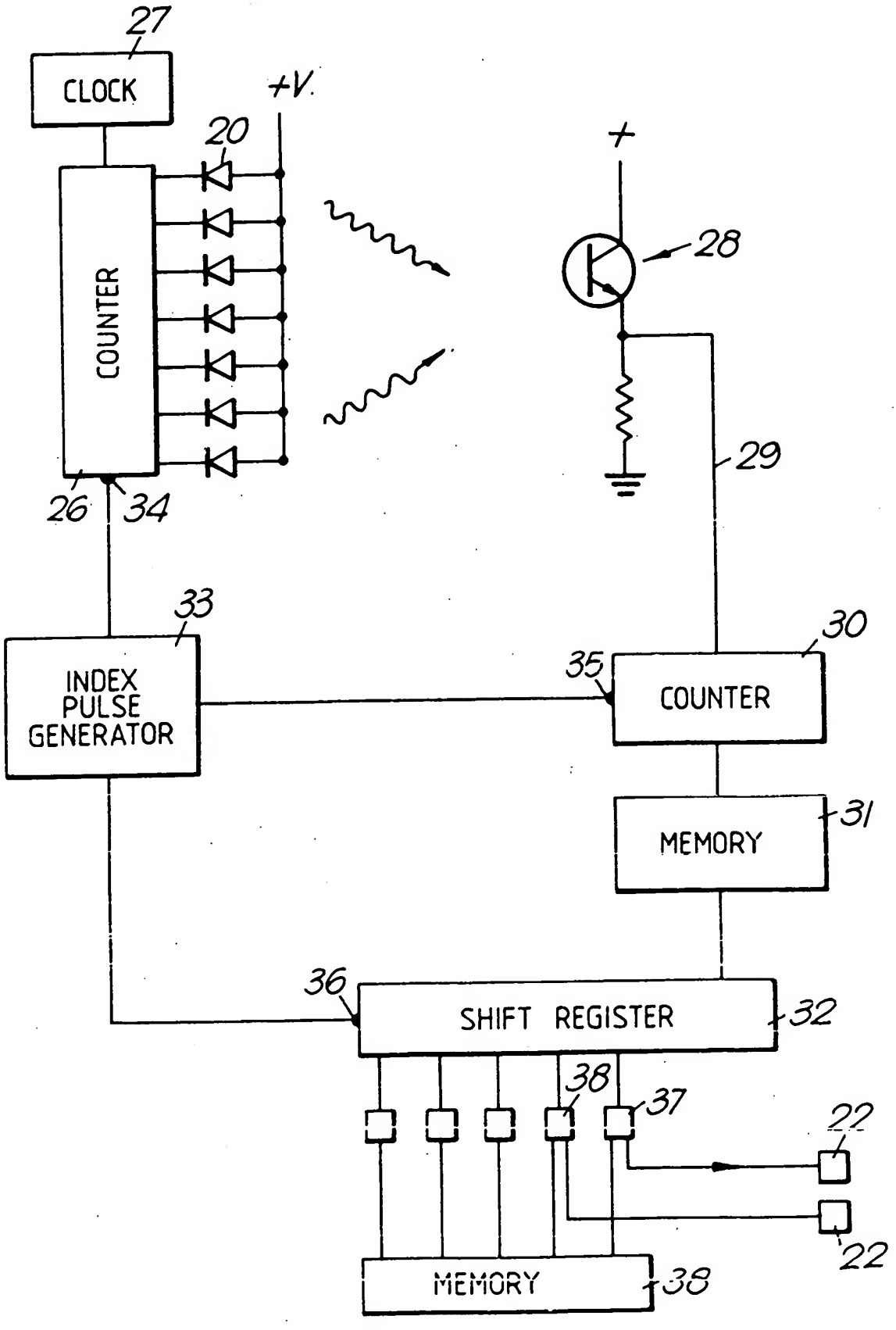
27
CLOCK
+V
20
COUNTER
+
28
29
26
34
33
INDEX
PULSE
GENERATOR
35
30
COUNTER
MEMORY
31
36
SHIFT REGISTER
32
38
37
22
22
MEMORY
38

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Fig.10.

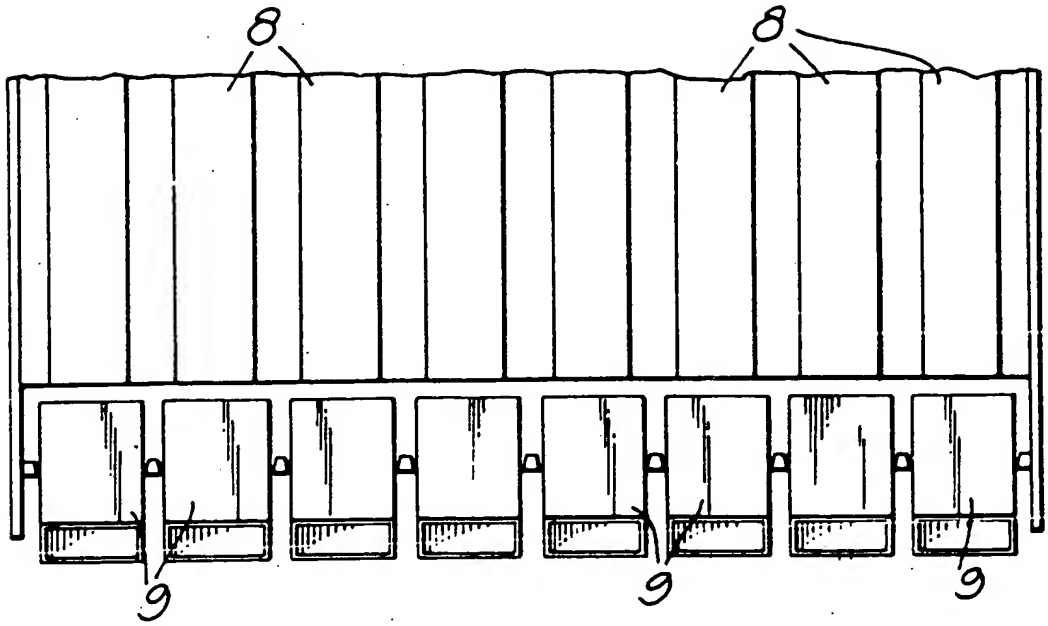


Fig.11.

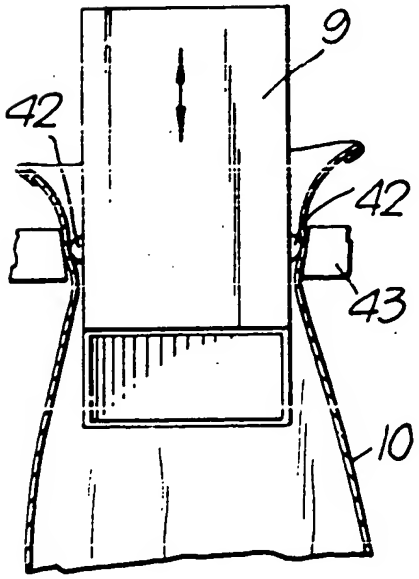
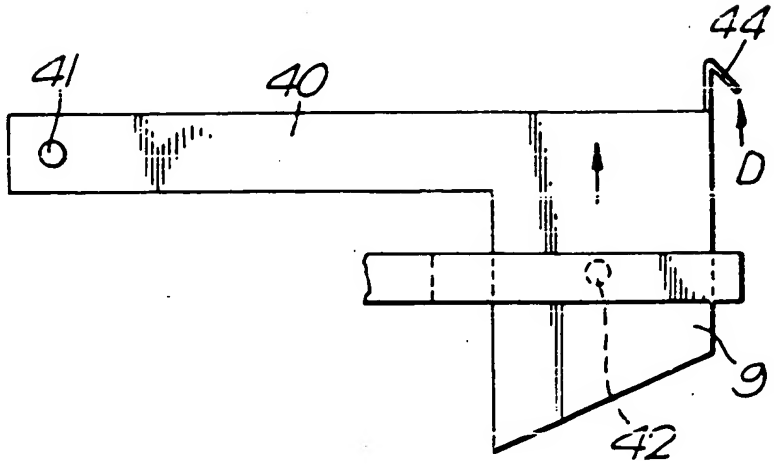


Fig.12.



SPECIFICATION

Coin sorting apparatus

This invention relates to a coin sorting apparatus and more specifically to a coin sorting apparatus that can be utilised to sort a mass of coins into a number of sets of coins, all the coins in any one set being of the same identity.

Throughout this specification the word "coin" is used in a broad context to cover, not only coins, but also tokens or other such devices.

According to one aspect of this invention there is provided a coin sorting apparatus, said coin sorting apparatus comprising movable means defining a plurality of recesses adapted to accommodate coin means for directing coins such that coins may become located in said recesses, means for identifying any coins within said recesses at one or more coin identifying stations present on the apparatus, a plurality of coin transportation paths located so that a coin within a recess will be directed past said coin transportation paths as said movable means advance and coin ejecting means for ejecting a coin from any recess as it passes any selected one of said coin transportation paths, the arrangement being such that, in operation of the device a coin becomes located in a recess, is identified and is subsequently ejected to pass down an appropriate coin transportation path.

Preferably each said coin transportation path includes a chute which may be directed towards a separate coin collecting bag.

Preferably said recesses are formed in a disc, such as in the periphery of the disc.

Conveniently the disc rotates in a recess defined by a flexible backing member, therebeing means for adjusting the spacing between the backing member and the disc, at least in the region of the disc where said recesses are provided.

Advantageously the means for identifying the coins comprise means for determining the diameter of the coins. Said diameter identifying means may comprise a plurality of light emitting sources located on one side of a recess and means located on the other side of the recess for detecting light passing from each light source through a portion of the recess not occupied by the coin, to the detector, therebeing means for determining the number of light sources whose light is detected in this way. Said light sources comprise a plurality of light sources arranged in a linear substantially array, the light sources being energised successively, the detector being associated with a counter such that as each light source that is not covered by a coin is energised a count is added to the count in the counter.

Additionally or alternatively the coin identifying means may include one or more induction arrangements to identify the material from which a coin is made.

Preferably the coin ejector means comprise a separate ejector member associated with each coin transportation path, each ejector comprising a member adapted to be moved from a recessed position to a protruding position, thus to eject a coin from a recess into an appropriate coin transportation path.

In a preferred embodiment said ejector member has a sloping face adapted to engage a coin within a recess, thus imparting a forward motion to the coin as the coin advances to eject the coin into the appropriate coin transportation path.

Conveniently said movable means comprise as inclined rotatable disc.

According to another aspect of this invention there is provided coin handling apparatus comprising means defining one or more recesses into which a coin may be inserted, means for causing said recess to follow a predetermined path, past one or more coin identifying stations and sequentially past the ends of a plurality of coin transportation paths, and means for ejecting a coin from the or a recess into any selected transportation path, said apparatus comprising a shift register, means for introducing into the shift register a signal representative of the value of a coin in the or a particular recess when the value of the coin has been determined by the coin identifying means, means for advancing said signal through said shift register in synchronism with an advancing movement of the recess accommodating the coin past the ends of said transportation paths and means for comparing the signal as it is shifted down the shift register with signals representative of the values of the coins that it is intended should pass down the respective coin transportation path, there being means for activating said ejector device when the signal in the shift register is identical with the signal with which it is compared, the arrangement thus being such that a coin of any particular value is identified and ejected to pass down a predetermined transportation path.

Preferably the signals with which the signals in the shift register are to be compared are stored in a memory, such as a read only memory, which may be replaceable to enable the apparatus to be reprogrammed, or a programmable memory.

Advantageously said recess is moved with an indexing movement, the signals in the shift register being shifted in synchronism with said indexing movement of the recess and each coin identifying procedure being completed within the space of time between successive indexing movement.

According to a further aspect of this invention there is provided an apparatus for supporting a coin collecting bag on a coin delivery chute, said arrangement comprising a collar defining an aperture, at least some of the walls of the aperture being inwardly inclined, and a substantially tubular member forming the lowermost part of the coin delivery chute, said tubular member being insertable into and retractable from the aperture in the collar in a substantially vertical direction, said tube carrying, on the outer surface thereof, means to engage the walls of the aperture defined by the collar.

Preferably each substantially tubular member is mounted on the end of a substantially horizontal arm which is pivoted for movement about a substantially horizontal axis.

Conveniently each tube and each aperture in the collar is of substantially square cross section.

Advantageously each tube is provided with one or more protrusions on the exterior surface thereof to engage the inwardly inclined walls of the aperture in the collar.

In order that the invention may be more readily understood and so that further features thereof may be appreciated, the invention will now be described by way of example with reference to the accompanying drawings in which:

Figure 1 is a perspective view of a coin sorting apparatus in accordance with the present invention;

Figure 2 is an enlarged view of the rotary disc of the apparatus shown in Figure 1;

Figure 3 is another enlarged view, on a greater scale, of the lower part of the disc shown in Figure 1 and the associated coin chutes;

Figure 4 is an enlarged view of part of the periphery of the disc;

Figure 5 is a sectional view of part of a modified embodiment of the invention;

Figure 6 is an enlarged view of part of the periphery of the disc at a coin identifying station;

Figure 7 is an enlarged view part of the periphery of the disc and another coin identifying station;

Figure 8 is a sectional view taken on the line VIII-VIII in Figure 3;

Figure 9 is a circuit diagram of part of the control arrangement for an apparatus in accordance with the invention;

Figure 10 is a front elevational view of the apparatus shown in Figure 1 illustrating some of the coin chutes and bag supporting devices;

Figure 11 is a sectional view through part of a coin supporting arrangement, and

Figure 12 is another vertical side elevational view of part of the coin support arrangement.

Referring initially to Figure 1 of the accompanying drawings a coin sorting apparatus in accordance with the present invention comprises a housing 1 having an inclined upper face 2. Located within a substantially circular recess 3 formed in the inclined upper face 2 is a disc 4. A motor, provided within the housing, causes the disc 4 to rotate in the direction of the arrow 5. As will be described hereinafter in greater detail a plurality of recesses 6 are provided in the outer periphery of the disc. A hopper 7 is provided which is located above the lower part of the disc, and coins can be inserted into the hopper 7, the coins then being directed into contact with the disc. It is to be noted that the lowest part of the hopper is located radially inwardly from the lowest part of the disc, so that at any instance the recesses 6 present in the lowest part of the periphery of the disc 4 are exposed beneath the lowermost portion of the hopper 7.

A plurality of coin guide chutes 8 are formed on the upper surface of the lower part of the housing 1 which, as will be described hereinafter in greater detail, direct coins into coin guide tubes 9 and thus, in this particular embodiment into coin collecting bags 10.

As will be described hereinafter in greater detail, in operation of the device coins are inserted into the hopper, and the disc 4 rotates. As the disc 4 rotates coins become located within the recesses 6. The coins are identified whilst in the recesses, and then as the disc continues to rotate the coins, within the recesses, pass the coin delivery chutes 8. When an identified coin reaches an appropriate delivery chute 8 the coin is ejected from the recess in which it is located, passes down the chute 8 and thus through the appropriate coin delivery tube 9 and into an appropriate bag 10. Thus the device can be utilised to sort and bag coins, tokens or the like.

Figure 2 illustrates the rotary disc 4 which is located within the recess 3 in the inclined upper surface 2 of the housing 1. As will become apparent the vertical wall defining the periphery of the recess 3 may be subjected to considerable wear, and thus in this embodiment of the invention the recess is lined with a removable liner 11 which can be replaced if and when it becomes worn. Part of the hopper 7 is illustrated which directs the coins onto the disc.

As can be seen most clearly in Figure 3, which illustrates the lower part of the disc and the hopper 7, the disc 4 is provided with a plurality of radially directed upstanding paddles 12 which are so located that the paddles pass, as the disc rotates, immediately adjacent the bottom of the hopper 7. Thus any coin present in the hopper will be swept round by the paddle 12 and will thus be directed towards the recesses 6 formed in the periphery of the disc at about the 9 o'clock position. Each recess 6, as can be seen most clearly in Figure 4, has a relatively wide mouth part 13 and a tapering base part 14. In an ideal arrangement each recess 6 is dimensioned so that it can only accommodate one coin at a time, but in some coinage system the situation is such that the diameter of the largest coin is approximately twice the diameter of the smallest coin, and in such a case it is conceivable that two coins 15 could become located in a single pocket 6 as shown in Figure 4. This is not ideal but if the dimensions of the coins are such that this situation may arise, the only practicable expedient is to incorporate means in the apparatus to sense the fact that two coins are present in a single recess and to take the appropriate action as will be described hereinafter.

The disc 6 has a thickness which is substantially equal to the thickness of the thinnest coin that is to be sorted. Thus, if two coins are superimposed and are thus both located in a single pocket, by view of the inclination of the disc the top coin will slide over the lower coin and thus will slide away from the pocket as the disc 6 rotates. In a modified embodiment of the invention, which is illustrated in cross section in Figure 5, the disc 6 may be mounted on top of a resilient backing member 16. The resilient backing member 16 is provided with an upstanding protruding annular wall 17 which effectively forms a recess corresponding to the recess 3 as described above, and thus the disc 6 is located within the recess defined by the resilient backing member. The resilient backing member is fixedly mounted in position at the centre thereof, and is provided with a plurality of screw adjustment devices 18 towards the periphery thereof. By tightening or loosening the screw adjustment means 18 the gap or spacing 19 between the rear face of the disc 6 and the upper face of the resilient backing member 16 can be

adjusted. This enables the apparatus to be adjusted for use with coins of different thickness and, if desired, the spacing 19 between the disc 6 in the backing member 16 may be adjusted to be different at various regions around the periphery of the disc 6.

As the disc 6 rotates coins will be directed, by the paddles, into at least some of the recesses on the left hand side of the disc. Each recess, as the disc rotates, will pass into a coin identification station 19 which is located at the 1 o'clock position. Figure 6 illustrates a recess 6 when at that position and also illustrates the possible positions that can be adopted by various coins 16 when the recess 6 is at that position.

Located under disc 4 at the position at that the recess 6 will occupy when the recess is in the coin detection station 19 are a plurality of light emitting diodes 20. As can be seen from Figure 6 the light emitting diodes are arranged in a straight line and are so located that by determining which diode or diodes are exposed when a coin is in position, the diameter of the coin can be detected. The control circuitry associated with the light emitting diodes will be described hereinafter. The disc 6 will advance and the recess under consideration, containing a coin, will eventually reach the 4 o'clock position where a second coin sensor station 21 is provided. Figure 7 illustrates the recess 6 when at this position, and it can be seen that the combined effect of rotation of the disc 4 and gravity has forced any coin 16 present within the recess to occupy one of the positions indicated, depending upon the size of the coin. Again a plurality of light emitting diodes 20 are provided under the disc 4, the diodes again being positioned so that by determining which diode or diodes are exposed the diameter of the coin within the recess 6 may be determined.

When a coin, within a recess 6, has passed the 4 o'clock position, the coin is exposed beneath the base of the hopper 7. The coin then passes the open tops of the coin delivery chutes 8. As can be seen most clearly in Figure 8 a plurality of coin ejector devices 22 are provided, each such device being located adjacent the periphery of the disc, at a position near the top of a respective coin chute 8. Each ejector device 22 is normally in a retracted position to be substantially flush with the base of the recess in which the disc 4 rotates. Under the influence of a control arrangement to be described hereinafter when a coin of a predetermined category reaches a predetermined coin ejection chute 8, the appropriate coin ejector 22 will be activated, and as a result a member 23 shown most clearly in Figure 8 is driven forward to protrude from the base of the recess in which the disc 4 rotates, and as the disc continues to rotate the coin 16 will be ejected from the recess and will pass down the appropriate chute 8. The coin may be ejected by the impact of the member 23 against the coin, or may be ejected by virtue of the fact that the member has a sloping face 24 which, as the coin moves past the member 23 in the direction of arrow 25 as a result of the rotary motion of the disc 4, engages the coin in such a way that a movement imparted to the coin which causes it to fall down the appropriate coin chute 8.

In the present invention the coin chutes are all directed to individual coin receiving bags 10, but it is to be appreciated that the coin chutes could be directed to other arrangements such as coin wrapping devices or large coin storage bins.

The electronic coin detection circuitry and the associated circuitry that controls the above described apparatus will now be described.

As has been mentioned before each coin detector is provided with a plurality of light emitting diodes, illustrated in the present embodiment as being seven diodes, but it is to be appreciated that any appropriate number of diodes may be utilised having regard to the particular set of coins or tokens that are to be utilised with the device.

Figure 9 illustrates the seven photo diodes of one coin detector, the diodes being connected to the outputs of a counter 26. The counter is driven by a clock pulse generator 27 and the arrangement is such that each diode 20 is successively energised for a brief period of time. Thus the light emitting diodes are strobed. As the diodes are energised light is transmitted by the diodes, and the light from all the diodes is intended to fall on a single photo-sensitive transistor 28 whenever there are no coins present in the appropriate recess. Of course, when one of more coins are present in the recess only the light emitted by certain of the diodes will be received by the photo-sensitive transistor 28. When each pulse of light is received by the photo-sensitive transistor 28, the transistor becomes conductive and thus a pulse is provided on an output lead 29 of the transistor which is detected by a counter 30. Thus, at the end of each cycle of operation the count present in the counter 30 is effectively representative of the diameter of the coin within the appropriate recess 6. The count within the counter may then be transferred to an appropriately programmed read only memory (or even a random access memory) which produces an output signal representative of the value of the coin in question. This signal is supplied to one input of a shift register 32. Alternatively the count present in the counter 30 may be utilised to identify the coin, and this count may be fed directly to the shift register 32.

The disc 4 is rotated in a stepwise or indexing manner in response to signals generated by an index pulse generator 33. These signals are supplied to a reset terminal 34 on the counter 26 and also to a reset terminal 35 on the counter 30 and thus, during each indexing step both these counters are returned to zero, ready to recommence counting when the next recess has been positioned within the coin detector. The index pulse is also transmitted to the shifting input 36 of the shift register 32 and thus, at each indexing movement of the disc, the contents of the shift register 32 move one step to the left as illustrated. Thus, as each recess 6 advances from the coin identifying station towards the coin chutes 8, a signal in the shift register 32 indicative of the identity of the coin in that recess will move towards the left. When any particular recess 6 has moved to a position wherein the recess is aligned with the right hand most coin chute 8 as illustrated in Figure 3, the signal representative of the coin present in that

recess has moved to a position within the recess 32 that is connected to a comparator 37, the other input of the comparator being connected to an appropriate position in a memory 38 that contains a signal representative of the value of the coins that it is desired to feed down the right hand most chute 8. The output of the comparator 37 is connected to the appropriate ejector device 22 and thus the arrangement is such that when the comparator 37 detects the same signal in the memory 38 and in the appropriate position on the shift register 32 the ejector device 22 is actuated thus causing the coin within the recess to pass down the appropriate coin chute 8. It is noted that a second comparator 38 is provided and connected between the next adjacent position on the shift register and the next adjacent position on the memory 38, and it will be appreciated that this comparator 38 will also actuate the appropriate ejector 22 when identity of signals is detected. Thus, as a coin within a recess moves stepwise past the open mouths of the coin chutes 8, simultaneously, and in a similar stepwise manner a signal representative of the identity of the coin is compared with signals representative of the identity of the coins that it is desired to feed down the respective chutes 8. When the two signals that are being compared are identical, the coin in the recess is ejected into the adjacent chute 8. It is to be appreciated that it will be a simple process to re-arrange the way in which the coins are ejected down the chutes, since it is only necessary to change the contents of the memory 38. This can be accomplished easily either by having various types of "plug-in" memory or by providing a memory of the type that can be re-programmed by an appropriate keyboard or the like.

It is to be appreciated that if the coin is not "recognised" by the device, the coin will remain within the recess and will circulate within that recess, thus not being ejected down a coin chute. Alternatively any coins that are not "recognised" may all be ejected down a predetermined chute.

Only a simple embodiment of the control circuitry has been described above, and in the apparatus described above two coin detector stations are provided. In this embodiment the first coin detector station will insert an appropriate signal in the shift register, and the second coin detector station will create an output signal which will be compared with the signal present in the shift register for the relevant recess. If the two signals are identical no action will be taken, but if the signals are different, then the signal present in the shift register will be adjusted so that the coin in question is not ejected as the coin passes the chutes but will rotate with the disc for a second time, so that another attempt can be made to identify the coin consistently.

Many modifications may be effected and if desired, devices operating inductively may be utilised to determine the material from which each coin or token is manufactured to assist in identifying the appropriate coins or tokens. This will necessitate some additional control apparatus, but the man skilled in the art will readily be able to prepare the appropriate circuitry.

Referring now to Figures 10, 11 and 12 it can be seen that each coin chute 8 is configured to direct coins running down the coin chute to a coin receiving tube 9. Each coin receiving tube 9 is of substantially square cross section, and each tube is mounted at the end of a horizontally arm 40 which is pivotally located by a pivot pin 41. Thus the tube is mounted for pivotal movement. Formed on the exterior of the tube are a plurality of protrusions 42.

Each tube 9 can therefore be pivotally lowered into and raised up out of a substantially square collar 43 that surround the tube. The collar has a tapering aperture formed therein, the opening narrowing towards the bottom thereof. As the tube is pivoted downwardly into the aperture in the collar 43 the protrusions 42 engage the sloping side walls defining the mouth of the collar. When a coin bag is to be mounted in position on any particular tube to collect coins directed down the appropriate chute 8 the cloth bag 10 is positioned by hand with the mouth of the bag port embracing the back of the tube 9. As the bag is then pulled the tube 9 is pivoted upwardly, increasing the clearance between the tube and the surrounding collar 43. The mouth of coin collecting bag 10 may then be easily moved upwardly through the aperture forming the collar 43, the mouth of the bag then surrounding the elevated tube 9. The tube may then be lowered back into position within the collar and the protrusions 42 will then serve to press the mouth of the bag 10 against the sloping side walls defining the aperture in the collar 43. As coins pass through the chute the weight of coins within the bag 10 will increase. This will tend to draw the mouth bag downwardly, but this action will serve to reinforce the locking effect of the protrusions 42 against the sloping walls of the aperture formed in the collar 43. Thus the bag will be securely mounted in position. However, when the bag is to be released it is only necessary to raise the tube 9 again by engaging the protruding portion 44 in lifting the tube, and the bag will then tend to move downwardly under its own weight. Thus it is a simple matter, using only one pair of hands, both to insert a bag in position on a tube, and to remove a full bag from a tube.

CLAIMS

1. A coin sorting apparatus, said coin sorting apparatus comprising movable means defining a plurality of recesses adapted to accommodate coin means for directing coins such that coins may become located in said recesses, means for identifying any coins within said recesses at one or more coin identifying stations present on the apparatus, a plurality of coin transportation paths located so that a coin within a recess will be directed past said coin transportation paths as said movable means advance and coin ejecting means for ejecting a coin from any recess as it passes any selected one of said coin transportation paths, the arrangement being such that, in operation of the device a coin becomes located in a recess, is identified and is subsequently ejected to pass down an appropriate coin transportation path.

2. An apparatus according to claim 1 wherein each said coin transportation path includes a chute.

3. An apparatus according to claim 2 wherein each chute is directed towards a separate coin collecting bag.

4. An apparatus according to any one of the preceding claims wherein said recesses are formed in a disc.

5. An apparatus according to claim 4 wherein the recesses are formed in the periphery of the disc.

6. An apparatus according to claim 4 or 5 wherein the disc rotates in a recess defined by a flexible backing member, therebeing means for adjusting the spacing between the backing member and the disc, at least in the region of the disc where said recesses are provided.

7. An apparatus according to any one of the preceding claims wherein the means for identifying the coins comprise means for determining the diameter of the coins.

8. An apparatus according to claim 7 wherein said diameter identifying means comprise a plurality of light emitting sources located on one side of a recess and means located on the other side of the recess for detecting light passing from each light source through a portion of the recess not occupied by the coin, to the detector, therebeing means for determining the number of light sources whose light is detected in this way.

9. An apparatus according to claim 8 wherein said light sources comprise a plurality of light sources arranged in a linear substantially array, the light sources being energised successively, the detector being associated with a counter such as each light source that is not covered by a coin is energised a count is added to the count in the counter.

10. An apparatus according to any one of the preceding claims wherein the coin identifying means includes one of more induction arrangements to identify the material from which a coin is made.

11. An apparatus according to any one of the preceding claims wherein the coin ejector means comprise a separate ejector member associated with each coin transportation path, each ejector comprising a member adapted to be moved from a recessed position to a protruding position, thus to eject a coin from a recess into an appropriate coin transportation path.

12. An apparatus according to claim 11 wherein said ejector member has a sloping face adapted to engage a coin within a recess,thus imparting a forward motion to the coin as the coin advances to eject the coin into the appropriate coin transportation path.

13. An apparatus according to any one of the preceding claims wherein said movable means comprise an inclined rotatable disc.

14. A coin handling apparatus comprising means defining one or more recesses into which a coin may be inserted, means for causing said recess to follow a predetermined path, past one or more coin identifying stations and sequentially past the ends of a plurality of coin transportation paths, and means for ejecting a coin from the or a recess into any selected transportation path, said apparatus comprising a shift register, means for introducing into the shift register a signal representative of the value of a coin in the or a particular recess when the value of the coin has been determined by the coin identifying means, means for advancing said signal through said shift register in synchronism with an advancing movement of the recess accommodating the coin past the ends of said transportation paths and means for comparing the signal as it is shifted down the shift register with signals representative of the values of the coins that it is intended should pass down the respective coin transportation path, there being means for activating said ejector device when the signal in the shift register is identical with the signal with which it is compared, the arrangement thus being such that a coin of any particular value is identified and ejected to pass down a predeterimed transportation path.

15. An apparatus according to claim 14 wherein the signals with which the signals in the shift register are to be compared are stored in a memory.

16. An apparatus according to claim 15 wherein said memory is a read only memory.

17. An apparatus according to claim 15 wherein said read only memory is replaceable to enable the apparatus to be re-programmed.

18. An apparatus according to claim 14 wherein said memory is a programmable memory.

19. An apparatus according to any one of claims 14 to 18 wherein said recess is moved with an indexing movement, the signals in the shift register being shifted in synchronism with said indexing movement of the recess and each coin identifying procedure being completed within the space of time between successive indexing movement.

20. An apparatus for supporting a coin collecting bag on a coin delivery chute, said arrangement comprising a collar defining an aperture, at least some of the walls of the aperture being inwardly inclined, and a substantially tubular member forming the lowermost part of the coin delivery chute, said tubular member being insertable into and retractable from the aperture in the collar in a substantially vertical direction, said tube carrying, on the outer surface thereof, means to engage the walls of the aperture defined by the collar.

21. An apparatus according to claim 20 wherein each substantially tubular member is mounted on the end of a substantially horizontal arm which is pivoted for movement about a substantially horizontal axis.

22. An axis according to claim 20, 21 or 22 wherein each tube and each aperture in the collar is of substantially square cross section.

24. An apparatus according to claim wherein each tube is provided with one or more protrusions on the exterior surface thereof to engage the inwardly inclined walls of the aperture in the collar.

25. A coin sorting apparatus substantially as herein described with reference to and as shown in the accompanying drawings.

23. Any novel feature or combination of features disclosed herein.

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